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Three modified two-queen colonies in 1946 gave an average of 241 pounds of surplus honey.

Modified Two-Queen System *for* Honey Production

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Ohio State University

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The Modified Two-Queen System For Honey Production

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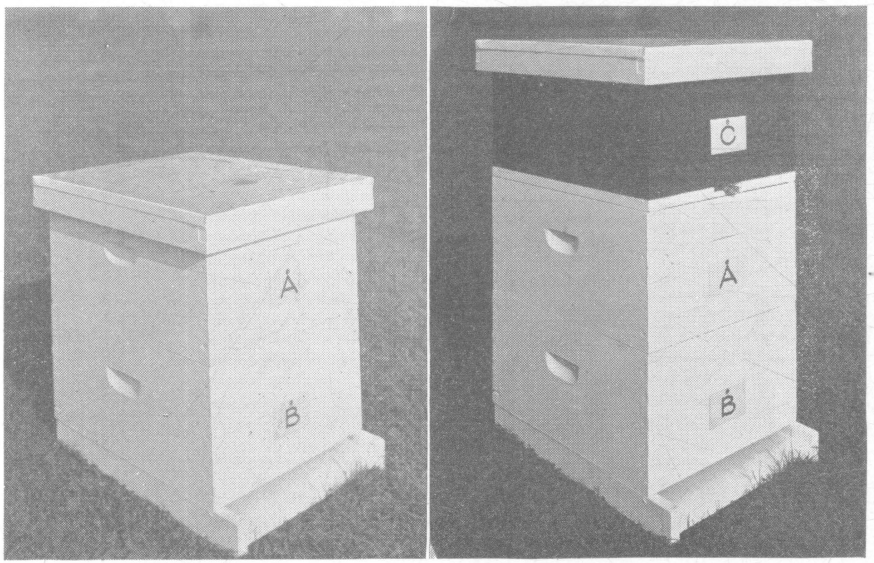
The modified two-queen system, worked out by the Ohio Experiment Station and tested for its usability for growers, is based on the principle employed in the standard two-queen system.

First, it is essential to understand the difference between the standard two-queen system and the Ohio modified two-queen system. The standard two-queen system utilizes two queens at least during a part of the building-up period and throughout the harvest period. During the harvest period supering involves going through the colonies every 10 days and supering the lower and upper units, which are each headed by a queen. This system is best adapted for a region characterized by a long honey flow, and represents an intensive type of beekeeping, where maximum yields of honey are harvested.

The Ohio modified two-queen system embodies the use of two queens in a colony during the building-up period; the reducing of such colonies to a single-queen system, during the early part of the



a *b*

Fig. 1.—(a) A two-story colony during early spring period. (b) Arrangement of a two-story colony for the two-queen system.

clover flow; and the arrangement of supers at this time, so that "top supering" is necessary only during the remainder of the harvest period. Since the duration of the clover flow in Ohio seldom covers a period of more than 5 to 8 weeks, the modified two-queen system provides all the advantages offered by the standard two-queen system, as far as storing strength of a colony is concerned, thus insuring practically the same potential possibilities for surplus honey. The fact that the colony is reduced to a single-queen system, when the equipment is light in weight, insures rapid manipulation and makes this system practical to the honey producer. Another equally important feature, from a honey producer's standpoint, is that super manipulations are completed at this time, except for later "top supering."

Spring Manipulation of Colonies

Colonies rating from medium to strong in bees, and possessing seven or more frames of brood, are ideal for this system. At the beginning of the fruit-dandelion nectar flow, or previous, if colony strength warrants, colonies should be selected for the manipulation. Briefly, the manipulation involves removing from the parent colony three frames of emerging brood and adhering bees, and three

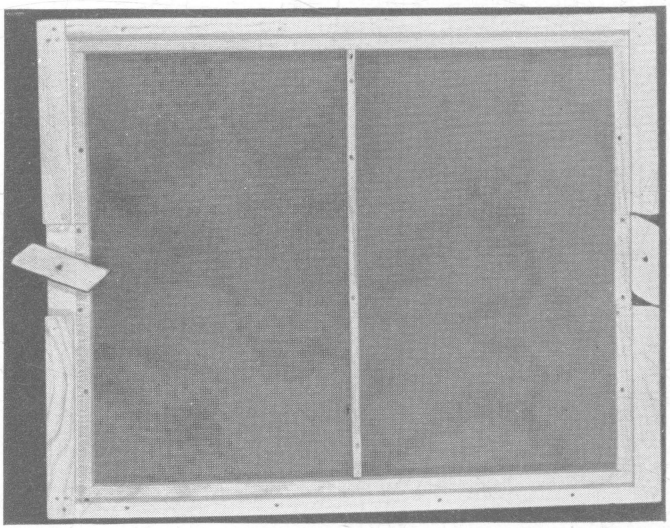
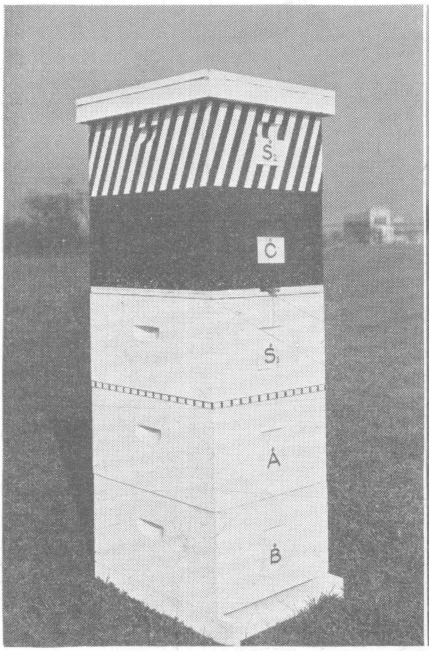


Fig. 2.—Special double screened inner cover.

frames of honey. The frames, containing brood, bees, and honey, are placed in a hive body and set over the parent colony, with a double-screened inner cover separating the two units. An entrance for the new unit is provided in the front portion of the double-screened inner cover. A young laying queen, purchased from the

South, is introduced immediately to the upper unit. At this time 5 pounds of sugar syrup should be fed the upper unit. Feeding the syrup will insure better acceptance of the queen and will stimulate the queen and bees to start rapid brood rearing. (See Figs. 1-a and 1-b, Page 3.)



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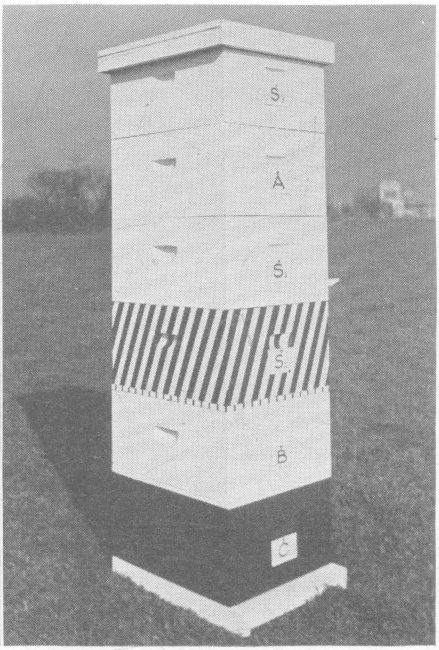

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Fig. 3.—Extracting supers added to both units with queen excluder over lower brood nest.

Fig. 4.—The two-queen colony (Fig. 3) reduced to a single queen system and hive bodies arranged for most advantageous storage of honey.

There are two features of the specially constructed inner cover which are important. (See Fig. 2, Page 4.) (1). The double screening of the inner cover, with a ¼-inch space between the two screens, prevents any communication of the bees in the parent colony with those in the upper unit, and, as a result, queen introduction is not a serious problem. (2). The heat from the lower unit rises and is of material aid in a more rapid development of the weaker unit. While less desirable, an ordinary hive inner cover may be used with a screen covering the upper and lower surfaces surrounding the bees escape opening. A slot may be cut in the rim of the inner cover to provide an entrance.

In cases where one-story colonies are used, a hive body of dark combs should be added to provide a two-story brood nest to the parent colony, thus supplying adequate breeding and storage space.

Successful Establishment of Upper Unit Vital

Beekeepers, arranging colonies for this system, may encounter disappointment in getting the upper unit properly established. For success, it is imperative to select frames of emerging brood with plenty of young bees adhering to the combs. Only the young bees will stay in the new hive body—the older bees, when taking flight, will return to the parent colony. If, when establishing the upper unit, there is any question of a lack of young bees, it is wise to make up any deficiency by shaking the bees off two or three frames from the parent colony into the upper unit. Care should be taken to make sure the old queen is not on these combs. Loose grass placed in the entrance of the upper unit will encourage more of the bees to stay in this unit. An ideal time to manipulate colonies is during a light nectar flow, when there is no tendency among the colonies to rob.

In about 10 days after the introduced queen starts laying eggs, it is advantageous to raise two more frames of emerging brood from the lower unit, as this will boost the upper unit and stimulate it to breed more rapidly.

Some beekeepers have asked the question, "Why not introduce the young queen to the lower unit and move the older queen into the upper unit?" The reason this is not recommended is that the stronger unit is always the lower one and, should the new queen not be accepted, it would so disrupt its development that it would likely be weak at the beginning of the clover flow.

Manipulation in Late May and Early June

The rate of development of these colonies obviously is influenced greatly by weather favorable to bees and blooming plants. Normally, the management already outlined will suffice during the fruit-dandelion nectar flow. In favorable years, there may be a light flow from white Dutch clover as early as May 25, but it seldom becomes intense enough for heavy supering of colonies until June 15. However, under normal conditions of development, colonies will need expansion room in late May or early June. A deep hive body of extracting combs should be added over a queen excluder to each parent colony. The upper unit is simply raised along with the double-screened inner cover and set on top of the extracting super given to the lower unit. At this time, the upper unit should also be examined, and, if it requires room for storage or room for the bees, a shallow, or deep extracting super is added over a queen excluder. The addition of this room is essential, so that the 10 frames in the brood nest in the upper unit will be available for brood rearing. (See Fig. 3, Page 5.)

In late May and early June, many of the top units will need a larger entrance. When nectar begins to be stored, it is generally necessary in the stronger units to raise one end of the hive body and rest it on supports to provide adequate ventilation.

Reducing the Two-Queen Colonies to a One-Queen System at the Beginning of the Clover Flow

The goal one should set is to have the two-queen colonies reach the desired strength before the clover flow becomes intense, and when the equipment is light in weight. For central Ohio, June 16 to 23 would be the period when the two-queen colonies could be reduced. The two-queen colonies, in which sufficient strength has not been attained, can be left until the next trip to the apiary, or later if desired. The later the reducing of the colonies to the one-queen system is deferred the greater becomes the weight of the equipment, which consequently slows up labor operations.

In Central Ohio, normal colonies at the time of treatment should contain 10 to 14 frames of brood in the lower unit, 8 to 10 frames in the upper unit, and bees overflowing in the hives. There should be a continuous nectar flow so that by the addition of smoke at the time of uniting these two units, there is no tendency among the bees to fight.

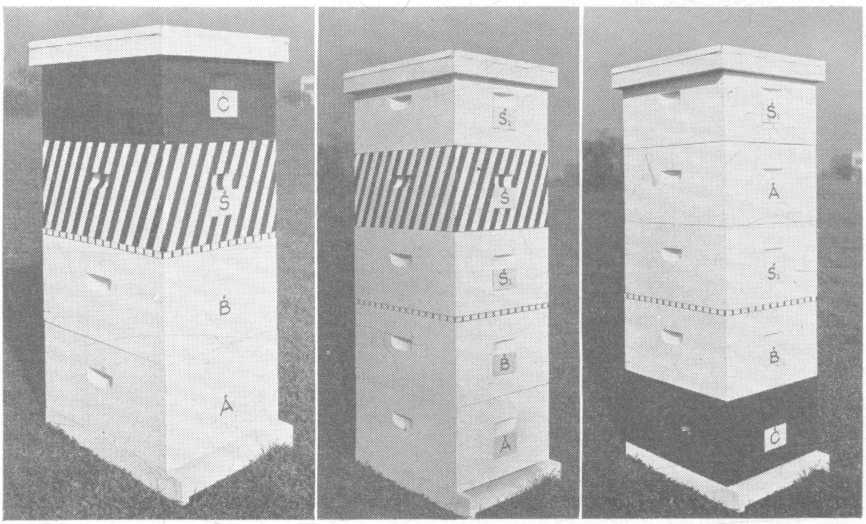
To reduce the two-queen colonies to a one-queen system, the following procedure is outlined: The upper unit, containing the young laying queen, is placed on the bottom board of the parent colony, and the old queen, in the lower unit, is found and removed from the brood nest. The frames of brood in the hive bodies A and B are arranged so that hive body A is full of brood and the frames of brood left in hive body B are of the emerging type. Hive body B is now placed over brood nest C. Super No. 2 containing drawn extracting combs, bees and new nectar, is now placed over the queen excluder, and then follows super No. 1, which is also well filled with bees and nectar. Brood nest A is now placed over super No. 1 and then super No. 3 is placed on top. If the colony needs more storage space during the honeyflow, supers may be added advantageously by the "top supering" method. (See Fig. 4, Page 5.)

It should be pointed out that the field bees in the upper unit will persist in attempting to enter the hive at the location of the upper entrance. To meet this situation, one of two methods may be utilized, depending upon the preference of the beekeeper. A queen excluder may be placed under brood nest A, but slid over far enough on the super below so that an entrance is provided. The use of a queen excluder will prevent emerging virgin queens in brood nest A from mating and establishing a brood nest in the supers. The other

method involves stacking the supers bee tight, which forces the field bees established to the upper entrance to drop to the lower entrance of the parent colony. Virgin queens, which may emerge from brood nest A, will not bring about swarming, when either of these two methods is followed.

Advantages of the Modified Two-Queen System.

The management of colonies by this system insures an enormous bee population at the beginning of the white Dutch and alsike clover flows. The reserve strength, in the form of brood, insures an



5b 8b 9b

Fig. 5b.—Hive body (c) containing young bees without queen placed over the super.
Fig. 8b.—Super from upper unit. Super containing nectar and young bees.
Fig. 9b.—Arrangement for swarm prevention.

enormous number of field bees for the sweet clover flow and the presence of a young queen, having the ability for heavy egg-laying, maintains the peak of bee population for the late sweet clover and alfalfa flows.

Requeening is accomplished with no interruption in brood rearing. Providing a two-story brood nest, which supplies an abundance of breeding space to the young laying queen at the beginning of the clover flow, is a primary factor in minimizing the swarming problem during the honey flow. The arrangement of supers, which are already occupied by bees and new nectar, as well as the position of brood nest A, insures equal distribution of the bees throughout the storage space, a primary factor in the maintenance of colony morale.

When colonies are reduced to the single-queen system, the brood nest, as well as the supers, are manipulated for swarm prevention. This means that the majority of the colonies will need no further attention from the standpoint of swarm control measures during the harvest period. While in the majority of cases, four supers will be sufficient for a colony, yet some of the better colonies in good years will need additional supers that may be supplied by the "top supering" method.

Honey yields are increased substantially by this system, as is shown by the 9 years of experimental work at the Ohio Experiment Station, which gave an increase ranging from 17 to 123 per cent more honey over the check colonies.

This system for honey production is best adapted to the smaller beekeeper or to commercial beekeepers operating less than 300 colonies. Commercial beekeepers operating 500 to 2,000 colonies will find difficulty in obtaining sufficient skilled labor and keeping their "time schedule" for the most successful results from the modified two-queen system.

An objection to this system is that, with modern standard equipment, the height of the colonies is so great it makes it inconvenient to harvest the honey crop in terms of man labor. A larger type hive or the use of a mechanical labor-saving device would help solve this problem.

Versatility Aspects of the Modified Two-Queen System

The modified two-queen system has unusual practical application, as a "new phase in bee management" for the large commercial beekeeper, in the following ways: for the conditioning of colonies at the beginning of the major clover flow; as a method of making increase of the colonies; as a simple method of testing the vigor of young queens; and as a method of insuring a fresh supply of young laying queens for requeening purposes.

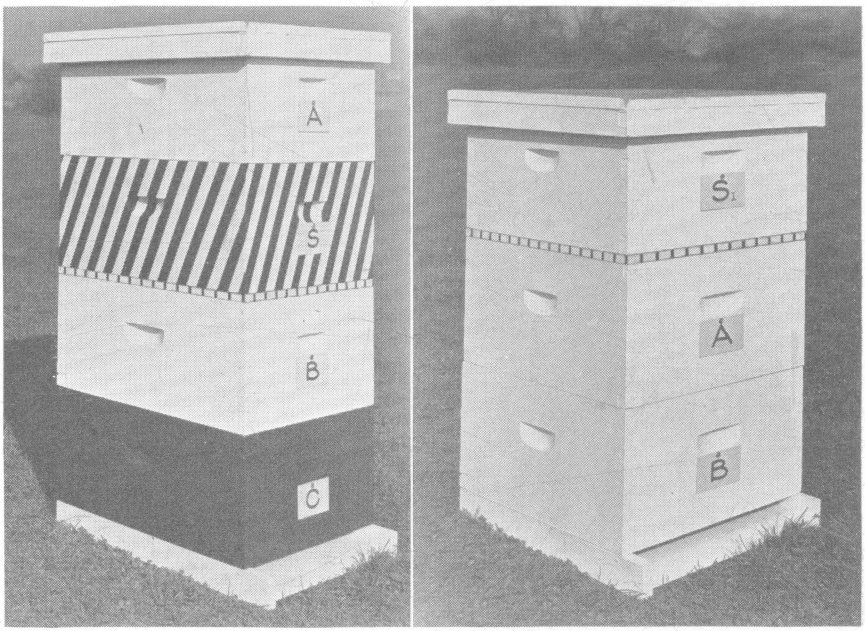
Conditioning Colonies at the Beginning of the Major Clover Flow

There is a wide variation among apiaries regarding the "general storing strength" of the colonies at the beginning of the clover flow. This variation of colony strength is influenced by a number of factors, such as: weather, forage plants, management, etc. It is probably quite safe to state that frequently 10 to 30 per cent of the colonies are definitely under par as producing units, although the

beekeeper has made an effort to bring his colonies to storing strength for the honey flow.

The modified two-queen system offers a solution to this serious problem and makes it possible to condition apiaries, so that approximately 100 per cent of the colonies will be in the "pink" of condition for the harvest period.

The immediate question asked by a beekeeper is: "How many colonies should be managed during the early spring period by the two-queen system so they will serve as a 'reservoir' for conditioning colonies at the beginning of the harvest period?" For central Ohio,



6b *7a*

Fig. 6b.—Arrangement of colony to correct strength and queen problem.
Fig. 7a.—Three-story colony with queen excluder between super and two-story brood nest.

tests have shown that a minimum of 10 per cent of the colonies should be managed by this system, and, for best results, 20 per cent is decidedly advantageous.

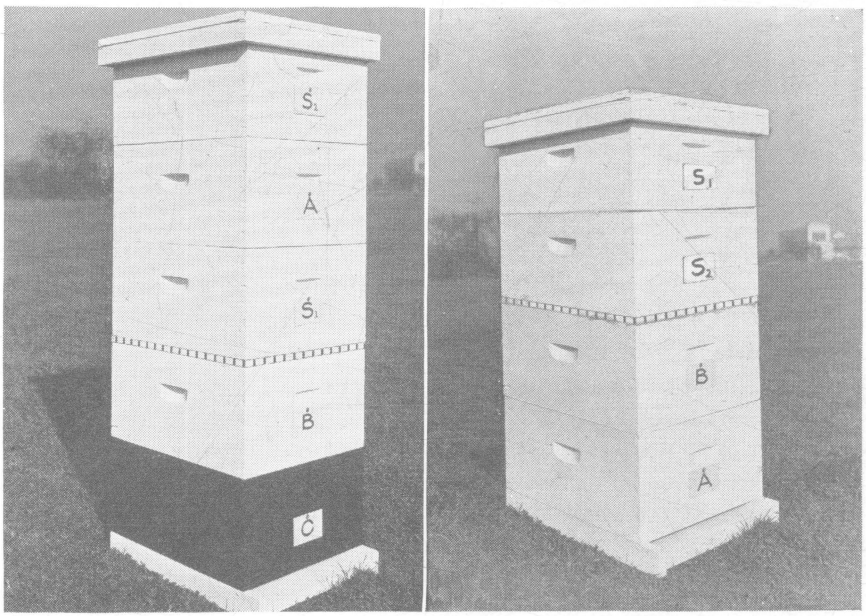
Colonies selected during the early spring for the two-queen system should all contain vigorous queens, a year or less of age, so that practically all the young queens established in the upper units will be available for the "conditioning phase of management" for abnormal colonies.

"Type Colonies" Which Need Conditioning at the Beginning of the Clover Flow

Type 1: Colony weak to medium in strength, but normal in other respects.

Figure 1-a, Page 3, indicates the general condition of this type of colony. In Figure 5-b, Page 8, is shown the colony *conditioned* so that a dependable producing unit will result. Brood bodies A and B are reversed in position as a swarm preventive measure and to stimulate the queen for rapid expansion of the brood nest. The super containing bees and nectar is removed from the upper unit of a two-queen colony and placed over brood nest B with a queen excluder separating them. Hive body C containing 7 to 10 frames of brood, young bees, and *without the queen* (brood nest of an upper unit of a two-queen colony) is placed over the super. (See Fig. 5-b, Page 8.)

After this manipulation, about 10 days will elapse before this type colony will begin to "reach its stride" and, from this time on, the colony will become more and more efficient as a storing colony. Colonies of this type will be able to take advantage of about two-thirds of the early flow, and for the later flow from sweet clover and alfalfa, they will be on a par with other strong colonies.



b *c*

Fig. 7b.—A strong colony "conditioned" by adding brood and a young queen (hive body C).
Fig. 7c.—Reversed brood nest (B and A) and young queen introduced.

Type 2: Colony weak to medium in strength which possesses an old, failing, inferior queen, or which has become queenless for a short time.

This type colony (Fig. 1-a, Page 3) is definitely a "boarder" colony, since it lacks a field force for the early flow, the limited amount of brood offers no possibility of augmenting the field force, and the poor queen lacks the capacity for egg-laying, necessary to insure a large bee population for the late type of nectar flow.

Conditioning this colony, so it will be a dependable producing unit, is possible by drawing help from one of the two-queen colonies. Remove the hive body C (upper unit), which will contain 9 or 10 frames of brood, young bees, and a young vigorous queen, and place this hive body on the bottom board of the unproductive unit. Hive body B is now placed over hive body C, thus serving as a swarm preventive measure and also offering adequate breeding space for the young queen. The super placed over the queen excluder should be taken from the upper unit. This contains young bees and nectar, which condition is ideal for the unproductive unit needing help. Brood nest A containing brood is placed over the super (queen removed if present), thus encouraging an equal distribution of the bees in the supers. This is especially important as a swarm preventive at the beginning of the clover flow. (See Fig. 6-b, Page 10.)

Type 3: Strong colony in queenless condition, or possessing an old, failing, inferior queen.

The duration of the queenless period determines the method of conditioning strong queenless colonies. If the colony has been queenless 15 to 20 days there will be practically no brood in the hive. (See Fig. 7-a, Page 10.) Such a colony should be arranged as shown in Fig. 7-b, Page 11. Hive body (upper unit), containing 7 to 10 frames of brood, bees, and a young queen is taken from a two-queen colony and placed on the bottom board of the queenless colony. Hive body B over C acts as a swarm preventive measure and provides abundant breeding space. Hive body A over super (S) is ideal for encouraging equal distribution of the bees in the storage room.

Such a conditioned colony will result in good production for the following reasons: (1). The large field force already present will take full advantage of the early flow. (2). The 7 to 10 frames of brood, along with the young bees, will replace worn-out bees and augment their numbers, thus insuring good crop storage during the middle of the flow. (3). The presence of a young queen will insure a large field force during the late sweet clover and alfalfa flows.

In queenless colonies, or colonies possessing old, failing and inferior queens containing considerable amounts of brood, the prob-

lem of conditioning involves removing the queen, queen cells, or both, and introducing a young laying queen, obtained from one of the two-queen colonies. This can best be accomplished, if the nectar flow is good, by taking a frame of brood from an upper unit containing adhering bees and the queen and placing it directly in the center of the brood nest of the colony needing the queen. Brood nests A and B should be reversed in their position. (See Fig. 7-c, Page 11.)

Type 4: A normal medium to strong colony, but backward in occupying supers.

Prompt occupation of super room at the beginning of the clover flow is essential in order to obtain favorable storing morale—otherwise with inactivity of the colony, swarming preparations are likely to occur (Fig. 7-a, Page 10). The following recommendation will help solve this problem: Reverse the positions of hive bodies A and B. (See Fig. 8-b, Page 8.) This will provide more inviting and accessible egg-laying space for the queen and stimulate her to greater activity. Select a super, well occupied with bees and nectar from one of the upper units of a two-queen colony, and place this super over super 1. (See Figure 8-b.) Then add another super (S_2) over the super designated as (S).

Type 5: A strong colony with normal amount of brood but showing dominant swarming characteristics.

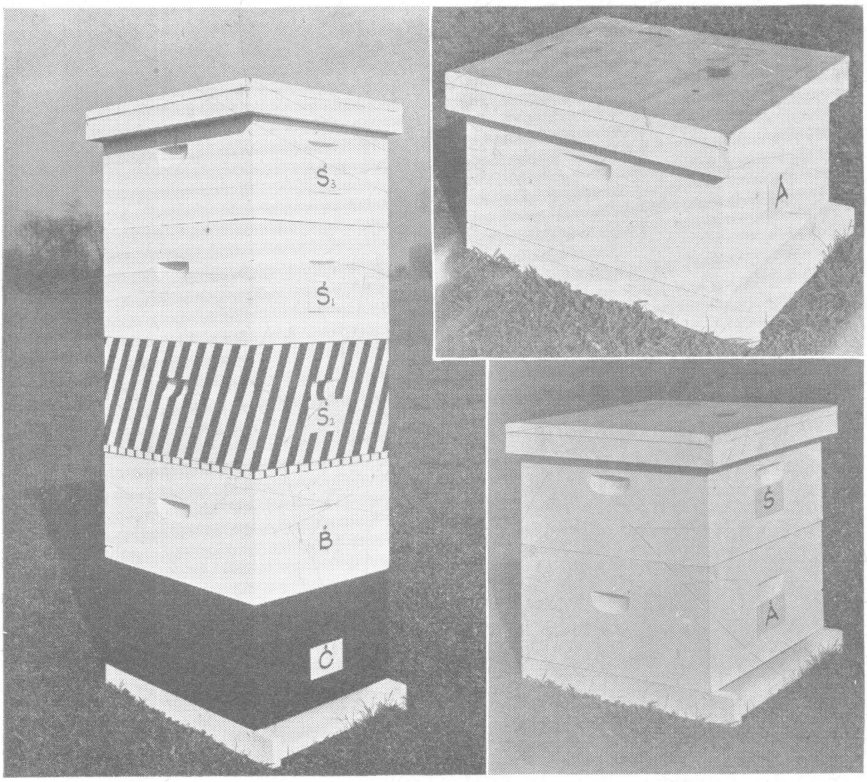
Colonies showing dominant swarming characteristics must be treated for swarm control and steps taken to establish a new strain from non-swarming stock. (See Figure 7-a, Page 10.) The modified two-queen system adapts itself also to solving this type of problem. Figure 9-b illustrates the treatment of such colonies, provided the young queen from the upper unit has demonstrated her vigor. It is desirable to select from a two-queen colony whose upper unit contains only 3 to 5 frames of brood, and establish a brood nest as shown in Figure 9-b. By placing emerging brood in hive body B, the new brood nest of two hive bodies (B and C) will provide adequate breeding space for the young vigorous queen. The super arrangement brood body A is also conducive to the proper distribution of the bees in the storage space, thus resulting in good colony morale.

Making Increase from the Colonies

A very economical and dependable method of making artificial increase is offered through the modified two-queen system. By skilled manipulation, increase can be made with little or no curtailment of production by the parent colony. The amount of increase possible to make depends upon the strength of colonies, the quantity and variety of forage plants during the building-up period, weather

conditions favorable to both bees and plants, and the earliness of the major flow. In central Ohio, when colonies are wintered properly, so they emerge from winter quarters strong and vigorous, as high as 50 per cent increase can be made by employing the modified two-queen colony management without affecting the amount of honey harvested from the parent colonies.

The increase should be made at the beginning of the clover flow when reducing the two-queen colonies to a single-queen system. (Figs. 3, 10-b, 10-c). The young queen is left in the producing unit for obvious reasons. Even old queens that show vigor and possess good laying ability are all right for the increase, since usually they are sufficiently hardy to build up the colony to desirable



b c d

Fig. 10.—(b) Reduced to a single queen system. (c) Increase in a one-story hive. (d) Second story of brood combs added.

strength for wintering. However, vigorous queens, one year or less in age, are preferable for the increase. The three frames of emerging brood and adhering bees (Fig. 10-c) offer enough supporting strength to the queen so that the colony will build up fairly rapid.

During the latter half of July and early August, it is important to supply a second brood body containing dark combs (nearly perfect combs), as many of these colonies will store heavily during a favorable nectar flow (Fig. 10-d and Fig. 11).

Method of Testing Vigor of Young Queens

When young laying queens purchased from the South are introduced to colonies, the operator may encounter losses, due to supersedure of queens, drone laying queens, unprolific queens, etc. The general problem is more serious than many beekeepers are aware of. A young, prolific queen, successfully introduced to a colony, is cheap at almost any price. However, an introduced queen, which proves unprolific, brings about a most serious problem because of the difficulty of correcting the harm soon enough, so the colony will give profitable returns.

The modified two-queen system presents an unusual opportunity as a cheap method of testing young queens for desirable qualities. The 5 to 7 weeks, the young queens are in the upper units, give an ample "trial period" so the beekeeper can determine the quality of queens before their introduction to full-sized colonies.

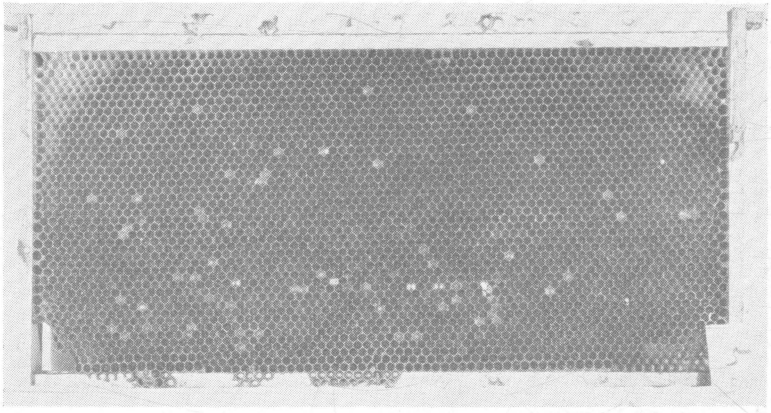


Fig. 11.—Nearly perfect dark worker comb.

Fresh Supply of Young Queens During Spring Building-Up Period

In the management of apiaries during the spring period, there is always the problem of queenless colonies, unprolific queens, supersedure of queens, drone laying queens and replacement of old queens. When ordering queens, after detecting some of the abnormalities listed above, much time is lost and consequent curtailment of brood-rearing results. From the time the beekeeper orders his queens by mail until such queens are laying normally in colonies, an interval of 17 days may elapse—a period of duration which is

almost disastrous as far as getting such colonies strong enough for the clover flow is concerned.

By having a supply of *young laying queens* in the upper units of the two-queen colonies, the beekeeper has an opportunity to draw on this supply at any time during the building-up period of the

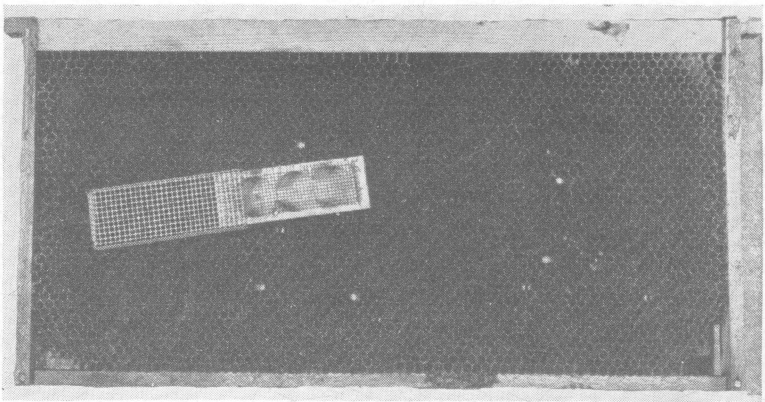


Fig. 12.—Supplementary introducing cage which is placed over the end of a regular queen mailing cage.

spring months. Since the queens in the upper units are laying heavily, they can be introduced with very little loss, and furthermore, since these queens are already conditioned, a minimum amount of time is lost by retarded egg-laying.

Should there be a continuous nectar flow from fruit, dandelion, or mustard bloom, and the temperament of the colony be gentle and quiet, the comb on which the queen is laying (upper unit), together with adhering bees, may be placed directly in the brood nest of the colony needing the queen. Only experienced beekeepers, who understand bee behavior, should attempt this method.

We generally recommend introducing the queen by the supplementary cage which is fastened over the end of a regular queen mailing cage (Fig. 12). Remove the perforated metal on the end of the mailing cage and place the cage on the comb so the open end is in a slightly downward position. Then place the supplementary push-in cage over the mailing cage. Precautions must be taken that the open end of the push-in cage fits tightly over the mailing cage, and also that the edges of the sides of the supplementary cage are inserted to the mid-rib of the comb to prevent the premature escape of the queen. The pasteboard on the other end of the cage containing the queen candy should be removed. In about 48 hours the bees will eat through the queen candy, and will come in contact with the queen. Frequently the queen will start egg laying on the comb enclosed by the push-in cage—an ideal condition for safer introduction of the queen.